EVERY KITCHEN IS A CHEMISTRY LAB

INVESTIGATING FOODS

PRESENTATION AT FAMILY AND CONSUMER SCIENCE
CTE SUMMER CONFERENCE
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Introduction

This project really started three years ago while I was studying for general chemistry. I detested the class in the worst way, but didn't want to let it get between me and my education/career goals. I keep telling myself, that if I would study long enough and hard enough, I would be able to build a bomb. It was the only thing that would keep me motivated. It wasn't until I graduated past general chemistry and some organic before I found the excitement I had been looking for. And best yet, the ingredients were all in my very own kitchen. The following lesson plans and ideas are only the beginning. There is no end to the number of variations that can be explored right inside your very own kitchen. Enjoy!

Valerie Stringham Peck

And a special thanks to my loving husband for all his support, ideas, and for cleaning all the dishes after my research!

How to use this Book

This book contains a collection of lesson plans based on food science. They were organized mainly for groups of 10 to allow more interaction and hands-on experience. Many can be adapted for larger groups. Several projects are designed to be used together. For example, it is recommended that **Acid/Base Reactions: It's not just Volcanoes!** be performed while either cupcake experiment is baking. Similarly, **Floating Eggs** can be used while waiting for **Why Boiled Eggs Crack**. But, any combination can be done. Evaluation sheets are included for all experiments with the exception of **Floating Eggs**. These can help to keep children calm in large groups, but are not essential. Discussing the same questions as a group may be just as effective, depending upon the situation. In presentations, the *Try it at Home!* section has been most valued by the children. This helps re-emphasize the principles learned, and creates an opportunity for quality time and learning with family members. **Activity Corner** is more hands-on projects kids enjoy. There is science behind them, but also a lot of fun. The **Additional Recipes** section is the beginnings of additional lesson plans, and some can be substituted for recipes in the lesson plans.

The Real Amazing Fruits: Pineapple, Kiwi, and Papaya

Estimated time: 35-40 minutes

Learning Objective following this session, the participants will be able to:

1) Discuss the effect of three enzymes on protein
2) Discuss the roll of enzymes and possibilities of why they would be in these fruits

Materials:

One fresh pineapple
2 kiwifruits
Cheese grater
Cheese cloth
Canned pineapple juice (4 oz)
½ lb. Beef stew meat, *or* boneless rib meat
4 zip-lock bags per fruit used
4 regular-sized dinner plates

Description:

This project tries to show how proteolytic enzymes in pineapple and kiwi affect meat over time. It is recommended to start the experiment first, then do discussion section while waiting for reaction to occur.

Adult preparation:

Note: Refrigeration will slow down enzyme activity of the fruits. It is best to leave them at room temperature from store-purchase to experiment. Papaya can also be used, but does not produce as dramatic of results. Meat is a potentially hazardous product. Keep refrigerated at all times so that the short amount of exposure for the experiment will not be harmful. If possible, adjust treatment time in variable to be longer so that more dramatic results can be seen.

Cut meat into 4 equal chunks. Place one in each zip-lock bag. Cut pineapple into quarters. Leave rind on section to be grated.

Results:

- If using pineapple, the majority of connective tissue between muscle strands will be dissolved. Dramatic changes will be visible after 15 to 30 minutes. The enzyme peaks at about 2 hours. Little change will be seen after this.
- Canned pineapple will have very little affect on the meat because the *bromelian* will have died in the canning process.
- Kiwi will powderize the meat. This reaction may not be visible until cooked. Look for color changes in the kiwi mash in the bag. Close inspection will show bits and pieces of the meat. A film will also begin to form on the top of the bag from dissolved fat.

If cooked, the pineapple should seem like it is a very overdone version of a chopped, pressed, and reformed meat product. The kiwi variable will seem like powder stuck together with gristle. Neither one will be very edible. The canned pineapple will be slightly more tender than the control, and will have a sweet flavor.

These fruits may have these enzymes as natural defense mechanism. Few bugs or worms are able to withstand the enzyme attack; so pineapple and kiwi are relatively pest-free plants.

Discussion:

An enzyme is something every living thing contains that makes things happen inside. Enzymes help with everything from digestion of foods, to keeping skin healthy. An enzyme is similar to a key that unlocks a door. Each one has a specific function and purpose.

A protein is like a building block for living creatures. All things that come from living plants and animals contain protein. It helps make plants strong, and makes muscle and skin for animals.

Pineapple, kiwi, and papaya have enzymes that break down proteins like raw meat and gelatin. That is why boxes of gelatin dessert say not to add fresh pineapple, kiwi, or papaya.

- Have you ever had fresh pineapple or kiwi burn a small cut on your hand?
- Have you noticed that eating a lot of these fruits can cause burning or sores in your mouth?
- This is caused by the enzymes that break down the protein. They are breaking down the protein in your mouth.

Today's experiment is to see how fresh pineapple juice affects a piece of stew meat.

Perform experiment. While waiting, discuss the following with the children:

- Where does (pineapple/kiwi) come from?
- Why would it have this enzyme?

Pineapple comes from Brazil and Paraguay[1]. It's Indian name (anana) means "excellent fruit." Columbus discovered it on a cannibal island in America, and was the first one to bring it to the Western World. The sailors thought it looked like a large pinecone, but was firm and juicy like an apple. Hence the name "pineapple"[2]. Pineapple contains *bromelian*, the protein-eating enzyme. This enzyme is so strong, that it has been rumored to eat the fingerprints off people working in pineapple factories. It is such a strong enzyme that it cannot be used to tenderize meats. Scientists know more about this enzyme than any of the other proteases, but lots of research still needs to be done.

The kiwi fruit or Chinese Gooseberry comes from China, but is now common to New Zealand. A unique thing about kiwi fruit plants is that it there are two different kinds: male and female[3]. *Actinidine* is the protease in kiwi. Very little is known about *actinidine*. Some researchers have found that stick ants also have *actinidine* in them to protect them from their enemies.

Papaya is native to Southern Mexico and Central America[4]. Columbus called this the "fruit of angels". It has a very smooth texture, and lots of vitamin C. Some think the flesh tastes similar to a cantaloupe, and the seeds taste like black pepper. Papaya contains *papain*, the enzyme that digests meat. This one is used in commercial meat tenderizers[5].

Recipe:

Control

- ✓ Leave meat in bag unaltered.
- ✓ Try to keep conditions the same as those with juice added.

Fresh Pineapple

- ✓ Have a group of students grate about an1/8th of the fresh pineapple with a cheese grater, and then strain the mash with cheesecloth. This should equal about 1 cup of juice.
- ✓ Scoop about 1/2 cup of juice into one bag and label.

Canned Pineapple

- ✓ Have a second bag filled with 4 oz. of canned pineapple juice

Kiwi

- ✓ Have students peel kiwi and mash with a fork. No straining is needed.
- ✓ Place about ½ a cup of kiwi mash in bag with meat chunk.
- ✓ Leave at room temperature for 15 minutes, or longer.

Directions:

- ✓ Place labeled bags of meat variables on counter for 15 minutes.
- ✓ Changes in color and texture will start so show after 5 minutes.
- ✓ Follow discussion questions.
- ✓ Display meats on individual plates. Mash slightly with a fork to show effect of enzyme on meat. Note all changes in appearance.
- ✓ If time allows, place meat back in bag for an additional 15 minutes.
- ✓ Most dramatic results will be seen after 30 minutes.
- ✓ Have students fill out evaluation sheet, or discuss as a group

Optional Methods:

Speed Option: 10 minutes can be saved by preparing the fruit juice in advance.
15-20 minutes can be saved by preparing one of the following options in advance.

A) Have participants scoop about 1/3 cup of juice into three of the bags. Label A, B, C, and D. Or write time-test amount on each bag (10 minutes, 20 minutes, 30 minutes). After each time interval, place entire contents of bag on a plate and cover with plastic wrap. Allow students to poke the product and examine as desired.

B) Have students place ½ a cup of pineapple juice into two bags. Leave the other two bags of meat as the control. After the first time limit, cook both a control and the variable in a 350-degree oven for about 10 minutes, or until the internal temperature reads 155 degrees. Repeat for next time variable. Have students compare the two products. If allowed, have a few students try a small piece of the product and evaluate.

References

1. Pineapple. California Rare Fruit Growers, Inc. Retrieved 30 March 2006 http://www.crfg.org/pubs/ff/pineapple.html.
2. Levins, H. Symbolism of the Pineapple: being the brief and colorful history of a truly American fruit. Retrieved 30 March 2006. http://www.levins.com/pineapple.html.
3. Kiwifruit. (1996). California Rare Fruit Growers, Inc. Retrived 30 March 2006. www.KIWIFRUIT Fruit Facts.htm
4. Papaya. Retrieved 30 March 2006. http://www.crfg.org/pubs/ff/papaya.html
5. Papaya. The world's healthiest foods. *Whole Foods, Inc*. Retrieved 30 March 2006. http://www.whfoods.com/genpage.php?tname=foodspice&dbid=47

How did the Enzymes affect the Meat?

How has the meat changed?

Is there a difference in color? What?

Does this look like something edible?

How do you think it will taste?

What did you like about this experiment?

Were you surprised by the results?

How did the length of time in the enzyme affect the meat?

Try it at Home!

Papaya Spare Ribs

Approx. 4 pounds of spare ribs
1 papaya
Salt and pepper to taste
Dash of red pepper flakes
Large zip-lock bag

Cut papaya in ½ and scoop out seeds. Rinse and reserve about 1/4 a cup of the seeds for fruit salad. Mash half of the papaya, and place in the zip-lock bag with spare ribs and red pepper flakes. Marinate for 10-15 minutes, no more. Season with salt and pepper, and grill for 10 minutes, or until done. Serve with fruit salad.

Tropical Fruit Salad with Yogurt Dressing

From *On Cooking*, Third Edition

1 large mango
¼ of a fresh pineapple
½ a papaya
2 grapefruits, segmented
1/4 cup papaya seeds
¼ cup pineapple or grapefruit juice
½ cup plain yogurt
2 Tablespoons honey
1 Tablespoon fresh lime juice
1 head butterhead lettuce, rinsed and separated
1 kiwi, peeled and sliced
1 teaspoon poppy seeds

1. Dice first three fruits into ½-inch pieces. Mix mango, pineapple, papaya, papaya seeds, and grapefruit together with the juice.
2. For dressing: whisk the yogurt, honey, and lime juice together.
3. Line 4 plates with butterhead lettuce leaves. Arrange mixed fruit on top of lettuce.
4. Drizzle with dressing. Toss poppy seeds over salad.
5. Garnish with kiwi slices.

Makes 4 salads

Mean Green Peanut Butter Sandwich

From KiwiFruit.org

Trust us... your kids are gonna love this one!

Ingredients:

- 1/3 ripe banana, cut into chunks
- 4 tablespoons low-fat cream cheese, room temperature
- 4 slices good quality pre-sliced whole wheat bread, toasted lightly
- 4 tablespoons creamy peanut butter
- 1 ripe California kiwifruit, unpeeled and sliced into 8 rounds

Place the banana pieces and cream cheese into the bowl of a food processor fitted with a steel blade. Pulse, scraping down the sides of the bowl, until they are just blended. Do not over-process. Alternately, you can mash the cream cheese and banana together until well blended.

Spread the banana cream on one side of two pieces of bread.

Spread the peanut butter on the remaining two slices of bread.

Divide the sliced kiwi between the two bread slices with banana cream.

Top with the peanut butter covered bread.

Cut diagonally into halves then cut again to make four sandwich triangles.

Makes two sandwiches.

How Different Acids affect Chocolate Cupcakes
Estimated time: 45 minutes

Learning Objectives Following this session the participants will be able to:

1) Discuss the differences between acids and bases, and their roll in the kitchen
2) Discuss what different acids can be used at home to make cupcakes
3) To learn that baking is fun!

Materials:

Flour
Cocoa powder
Sugar
Baking soda
Vegetable oil
Vanilla
Water
Vinegar
Buttermilk
Baking powder
Cream of tartar
Liquid egg mixture

4 mixing bowls
4 spoons
4 sets of measuring cups
4 sets of measuring spoons
4 butter knives, or leveling spatulas
4 colors of cupcake liners, six of each color
pans for 24 cupcakes
frosting
sprinkles
napkins and/or small paper plates
no-stick cooking spray

Description:

In this experiment, we will try 4 kinds of leavening agents in the same chocolate cupcake recipe, and evaluate their effect on color, texture, and flavor.

A) Control (baking powder and some soda)
B) Baking soda and cream of tartar
C) Baking soda and vinegar
D) Baking soda and buttermilk

Adult Preparation:

Pre-heat oven to 350. Place six of each color of paper liners in cupcake pans, preferably in the same area. Lightly spray the inside of each liner with the no-stick cooking spray (this keeps the paper from sticking to the cupcake). Have children measure out, being sure to use the knives or spatulas to level the tops of the scoops. Mix well. *for a faster assignment, and less materials, this could be done ahead by an adult.

Note: At least two adult helpers are needed for this experiment

Results:

The vinegar variable should make the least-dense cupcake, and sometimes has an aftertaste. The buttermilk will be the most “fluffy”. The baking powder variable should be the darkest in color, and is usually the preferred in flavor. Cream of tartar will create the lightest color, and be average in texture.

Discussion Before:

- Ask the children if the know what happens when vinegar is poured onto baking soda.
- Do you know that is the same kind of reaction that happens when baking powder is put into a cake or cookie mix?
- Did you know that there are a lot of other things in your kitchen at home that will make the same foaming reaction?
- The vinegar is an acid, and the baking soda is a base called sodium bicarbonate. Baking soda is about the only base used in cooking, but there are lots of acids.
- Today, we are going to try using vinegar, buttermilk, cream of tartar, and baking powder to make our cupcakes light and fluffy.
- Which one do you think will work the best?
- Have you seen any of these at home?

Discussion After:

- Have children mix together. Warn them about over-mixing.
- Did any bubbles form in the batter?
- Was there a difference in color between other group's mixtures?

Variations

Basic Recipe:
½ cup plus 2 Tablespoons flour
2 Tablespoons cocoa powder
1/3 cup sugar
¼ teaspoon baking soda

Assign each group a variable. For the powdered variables, have them mix into dry mixture before adding additional ingredients.

Cream of Tartar (blue cupcake liners)
½ teaspoon cream of tartar, then wet ingredients
2 Tablespoons vegetable oil
½ teaspoon vanilla
1/3 cup water
2 Tablespoons liquid egg

Baking Powder (white cupcake liners)
1 teaspoon baking powder, then wet ingredients
2 Tablespoons vegetable oil
½ teaspoon vanilla
1/3 cup water
2 Tablespoons liquid egg

Vinegar (pink cupcake liners)
2 teaspoons vinegar
2 Tablespoons vegetable oil
2 Tablespoons liquid egg
1/3 cup water
½ teaspoon vanilla

Buttermilk (yellow cupcake liners)
½ cup buttermilk
2 Tablespoons vegetable oil
½ teaspoon vanilla
2 Tablespoons liquid egg

Bake for 15 minutes. While waiting, ask Perform **Acid/Base Reactions: It's not just Volcanoes!**

When cupcakes are finished and slightly cooled, cut one or two of each into small pieces, and allow the children to sample each one. Have them fill out the evaluation form. Cupcakes will usually be sufficiently cooled. Allow the children to frost, decorate and enjoy!

What makes the Best Chocolate Cupcakes?

Which one was the fluffiest?

Which one had the darkest chocolate color?

Which one had the lightest color?

Did any of them taste funny?

Which one tasted the best?

Which one could you eat every day?

White: baking powder and a little baking soda
Pink: baking soda and vinegar
Blue: Baking soda and cream of tartar
Yellow: Baking soda and buttermilk

Try it at Home!

Benny's Birthday Cake

From the Boxcar Children's Cookbook

2 ½ cups flour	2 round 9" cake pans, or 24 cupcakes
½ cup cocoa powder	large mixing bowl
1 ¾ cup sugar	electric mixer
½ cup vegetable oil	measuring cups
2 teaspoons vanilla	rubber scraper
1 ¾ cup water	no-stick cooking spray
2 eggs	table knife
2 teaspoons baking soda	toothpicks
2 Tablespoons vinegar	wire cooling rack

1. Preheat oven to 350 degrees. Spray the cake pans with no-stick cooking spray.

2. Put flour, sugar, cocoa, and baking soda into the mixing bowl. Mix on low until well blended.

3. Add cooking oil, vinegar, vanilla, and water. Mix on medium until smooth. Scrape sides and bottom of the bowl with the rubber scraper to make sure all ingredients are blended.

4. Divide the batter evenly between the cake pans.

5. Bake 35-40 minutes. (15 minutes for cupcakes) Test by sticking a toothpick into the center of each layer. If the toothpicks come out clean, the cake is done.

6. Cool 15 minutes on wire rack.

Variations:

A. If you liked the baking powder cupcakes best, substitute baking soda and vinegar for ½ teaspoon baking soda, and 1 Tablespoon baking powder.

B. For buttermilk variation, substitute water with 2 cups buttermilk, and omit vinegar.

C. Cream of tartar: Substitute vinegar with 4 teaspoons cream of tartar

The Science of Crispy Rice Treats
Estimated time: 20 minutes

Learning Objectives Following this session the participants will be able to:

1) Discuss the functions of each ingredient
2) Discuss how to modify the ingredients to obtain a desired quality

Materials:

Marshmallows
Crispy rice cereal
Margarine
Food coloring
Non-stick cooking spray
4 –9x13 baking pans
4 microwave-safe bowls, *or* 4 saucepans
plethora of pot holders
butter knives (to cut treats later)
small paper plates (for service)

Description:

In this experiment, three different variables will be applied to crispy rice treats. The students will be asked to evaluate the effect of each on the texture and flavor of the treats. A) Control, B) extra marshmallows, C) extra butter, D) extra heat.

Results:

The variable with the most time should be very hard. Extra marshmallows will create a much messier and "stickier" product, while the extra butter should create a messy, soggy product that will not easily hold its shape.

Note: Even though recipe is cut in half, it is recommended to still press into a full-sized pan so more samples will be available for each child. For a large group, double each recipe, or try assigning two groups perform each experiment.

Discussion:

- There are only three ingredients in Crisp Rice Treats: marshmallows, crisp rice cereal, and margarine or butter.
- Marshmallows were first made from egg white foam, gelatin foam, and a thick sugar syrup. Store-bought marshmallows usually don't have egg whites anymore. Marshmallows are what add the "sticky" texture to the crispy rice treats, and also keeps the butter from being absorbed by the crisp rice cereal.
- Crisp rice cereal adds structure to the mixture, as well as crunch.
- Margarine or butter keeps the sticky marshmallows from being too sticky, and also contributes a rich, creamy flavor.
- A fourth variable exists as the amount of heat that is applied to the mixture. Too much heat will make the sugar syrup in the marshmallows become harder, and create a crisp rice treat that is also harder.
- All these ingredients work together to form the sweet, soft and slightly sticky mixture people of all ages adore.

Recipe:

Control (no color)
1 ½ Tablespoons butter or margarine
5 oz. Marshmallows—about ½ a package
3 cups crisp rice cereal

Extra Marshmallows (blue)
1 ½ Tablespoons butter or margarine
5 oz. Marshmallows—about ½ a package
Plus ½ marshmallows, or 4 large
3 cups crisp rice cereal
A few drops blue food coloring

Extra Butter (yellow)
2 ½ Tablespoons butter or margarine
5 oz. Marshmallows—about ½ a package
3 cups crisp rice cereal
A few drops yellow food coloring

Extra Heat (pink)
1 ½ Tablespoons butter or margarine
5 oz. Marshmallows—about ½ a package
3 cups crisp rice cereal
A few drops red food coloring
Microwave 45 seconds longer than the other groups

Microwave butter in a large bowl for 20-30 seconds, or until melted. Add marshmallows, and coat with butter. Microwave an additional minute, or until marshmallows are completely melted and mixture is well blended. Add 2 or 3 drops of food coloring. Stir for about 45 seconds, or until completely smooth.

Add crispy rice immediately, and stir until lightly coated in sauce. Press firmly into greased pan. Allow to cool a few minutes (can be placed in freezer to speed up time).

Directions:
Cut a sample of each variable. Only a 1" cube is needed to evaluate. Have students try one of each variable, and fill out the evaluation form.

What makes Crispy Rice Treats so Soft?

Which one was the softest?

What are the textures like?

Which one was the crunchiest?

What made it so crunchy?

Which one tasted the best?

Why did you like it?

What would you change about the way you make these at home now?

Try it at Home!

Dessert "Sushi"

Ingredients:

- **½ package marshmallows**
- **1 ½ tablespoons butter or margarine**
- **3 cups crisp rice cereal**
- **¼ pound gummy worms**
- **6 green fruit roll-ups**

Lightly grease a 9x13 pan with no-stick cooking spray. Unwrap all fruit roll-ups, and cover bottom of pan.

Microwave butter in a large bowl for 20-30 seconds, or until melted. Add marshmallows, and coat with butter. Microwave an additional minute, or until marshmallows are completely melted and mixture is well blended. Stir for about 45 seconds, or until completely smooth.

Add crispy rice immediately, and stir until lightly coated in sauce. Press firmly on top of fruit roll-ups. Allow to cool for a few minutes, but not until set.

Arrange a row of gummy worms about an inch from the shorter edge of the pan. Loosen edge of pan with a knife. Gently roll all layers until gummy worms are covered. Cut to form a roll. Repeat steps until all of crispy treat is used.

Allow crispy rice treat to cool completely. Cut into 1-inch thick slices. Serve and enjoy!

Did you know that in Japan, when something (like a suitcase) is packed to overflowing, they would say, "it's packed like a sushi" because sushi must be rolled very tightly so that it will stay together when eaten with chopsticks.

Why Boiled Eggs Sometimes Crack

Estimated time: full experiment—35 minutes, shortened version—15 minutes

Learning Objective following this session, the participants will be able to:

- ✓ To understand there are layers in an egg
- ✓ To know why eggs crack when boiled, and ways to prevent this.

Materials:

1 dozen eggs, grade A
4 saucepans, similar in size and weight
water
salt
vinegar
1 pushpin
kitchen timer
4 bowls for display
labeling material
plethora of hot pads

Description:

Eggs will be boiled under 4 different circumstances. A control (no intervention), salt water, vinegar water, and pierced shell. Each will be evaluated to see which method best prevents eggs from cracking.

Shortened Version: Prepare experiment at home. Have discussion, and then display each variable on a labeled paper plate. Have students fill out evaluation sheet.

Results:

- ✓ The control should have at least one of eggs crack, and the largest amount of egg should escape.
- ✓ The salt and vinegar should also experience a few cracked eggs, but the amount of white that has escaped should be reduced.
- ✓ None of the pierced eggs should crack, because all pressure could easily be released

Note: Boiling eggs at the highest temperature can also increase cracking because the larger bubbles jostle the eggs more roughly.

Speed Option: If less time is allowed, prepare experiment according to directions before hand. Discuss with children, then allow them to evaluate.

Discussion:

- ➢ Have you ever seen an egg crack when it was boiled? Why did that happen? Why do some eggs crack and others do not?
- ➢ Eggs have many layers inside. One is a small air gap at the fatter end. The older an egg is, the larger the air gap becomes.
- ➢ When eggs crack while boiled, it is because the air cannot escape through the small holes in the shell fast enough.

- A lot of pressure builds up inside, and the shell isn't strong enough to hold it, so the shell cracks. It's similar to popcorn popping, but not quite as violent.

- Have you ever seen someone put salt or vinegar into the water of the boiling eggs? Why do they do that? Does it prevent the eggs from cracking?
- No, but it does help less egg from escaping the shell when it does crack. It's helping to "plug the hole", like a tire patch, or piece of tape over a hole in a balloon.
- If eggs crack because the air cannot escape, what would happen if we poked a hole into the egg before it was boiled? (egg should not crack, because pressure can escape.)

Directions:
Pierce the large end of an egg with a pushpin. Explain that the egg does not leak out here because of the air gap at this end of the egg. We use a pushpin because it is short, and can't go in too far to puncture the air gap.

Have students separate into 4 groups, each with a different variable. Have them place about a quart of water and three eggs in each pan. Place on stove on medium-high, and boil for about 15 minutes.

- After boiling, have an adult remove the pans from stove very carefully.

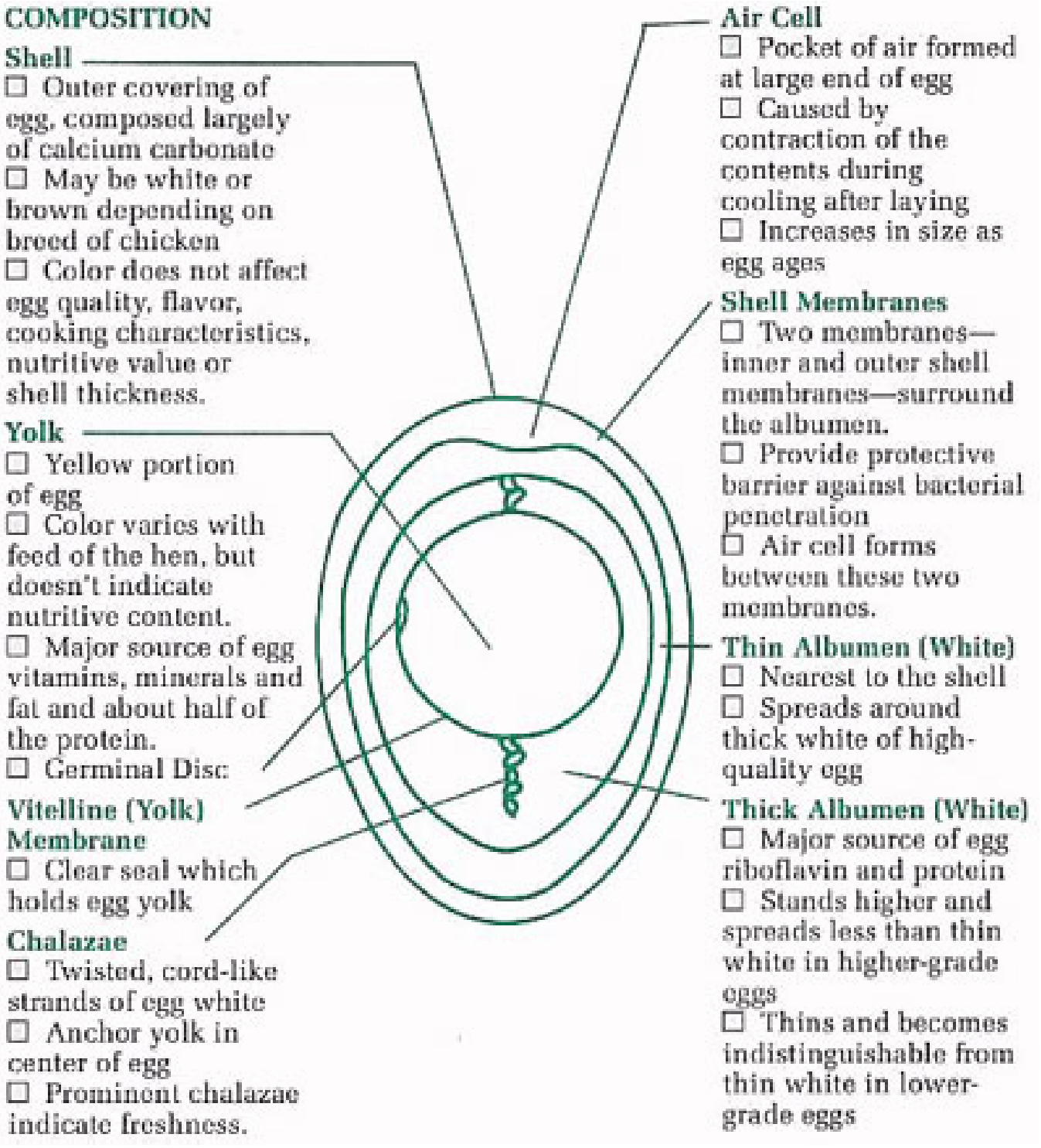
- Place each pan in a sink, and allow cool water to trickle into pan for a few minutes, or until all boiling water is gone.

- Gently remove eggs from pan with slotted spoon, and display in appropriately labeled bowls.

- Have students fill out evaluation sheet.

Suggestion: Perform **Floating Eggs** while waiting for eggs to boil.

References: *Food science: kitchen mysteries revealed.* (2000). Learning Seed. Lake Zurich, Ill
New cook book (1989). *Better Homes and Gardens.* Meredith Corporation. Des Moines, Iowa. 146.



from The American Egg Board. http://www.aeb.org/LearnMore/EggFacts.htm#aircell

Boiled Eggs: Why do they Crack?

Which one worked the best?

(Control, Salt Added, Vinegar Added, or Pierced egg?)

Why did the best one work?

Which one was the worst? (had the most crack, and most egg escape)

How many of the eggs cracked?

Control_____ Salt Added_____

Vinegar Added_____ Pierced Egg_____

Which one would you try at home?

Deviled Eggs

From Better Homes and Gardens *New Cook Book*

6 hard-cooked eggs
¼ cup mayonnaise or salad dressing
1 teaspoon prepared mustard
1 teaspoon vinegar
Paprika or parsley sprigs (optional)

Cut eggs in half length-wise, and remove yolk. Place yolks in a bowl; mash with a fork. Add mayonnaise, mustard, and vinegar; mix well. Season with salt and pepper, if desired. Stuff egg white halves with yolk mixture. Garnish with paprika or parsley, if desired. *Makes 12 servings. Variations:* Try omitting mustard and adding ½ teaspoon of curry powder for an Indian-style egg, or ½ teaspoon chili powder, dash of red pepper and 2 Tablespoons diced green chilies for a Mexican-style egg.

Acid/Base Reactions: It's not just Volcanoes!

Large Group Presentation

Estimated time: 10-15 minutes

Learning Objectives following this session, the participants will be able to:

1) Discuss the purpose of baking powder and how it makes things rise.
2) To understand that other acid/base reactions can be used to create the same effect

Materials:

5 quart jars
Baking soda
Baking powder
4-1/2 measuring devices
Vinegar
Lemon juice
Buttermilk
Cream of tartar
Tape
Markers
Table covering

Description:

In this experiment, 4 different acids will be reacted with baking soda. Each reaction will be evaluated for speed, height, and length of time that reaction continues. The results will then be compared to baked goods with similar acid/base properties, and differences between the baked product and jar reaction will be discussed. A second presentation can be made using baking powder and water, and compare with baking soda and cream of tartar equivalent. The differences between the two (cornstarch) can then be evaluated.

Results:

The vinegar will react the fastest, then lemon juice (which sometimes is the highest). The cream of tartar solution will not foam very much, but will continue to make fizzing bubbles (similar to a soda pop) for several minutes. Little change will be seen in the buttermilk solution. The opposite reaction will be seen in the cupcakes. Buttermilk will be the lightest, followed by cream of tartar. Vinegar will be the last. This is because the carbon dioxide released by the vinegar and baking soda in the batter escapes before the cupcake is baked enough to trap the air inside. The buttermilk is the slowest to react, so it continues to form bubbles while in the oven.

Discussion:

- Everyone has seen what happens when vinegar is poured onto baking soda, but did you know that this is the same reaction that causes muffins, brownies, cakes, cookies and lots of other baked goods to rise when they are cooked?
- What are acids and bases?
  Acids are sour and feel "scratchy"
  Bases are bitter and feel slippery
  - What are some things in your house that taste *sour*?
  - What are some things in your house that taste *bitter*?

- Acids and bases are opposites. When they are mixed, they foam and usually only salt and water will be left. The foam is caused by carbon dioxide that is trying to escape.

- The vinegar is an acid, and the baking soda is a base called sodium bicarbonate. Baking soda is about the only base used in cooking, but there are lots of acids.

Common Household items

Acids:	*Bases:*
Lemon Juice	Baking soda
Vinegar	Soap
Cream of tartar	Cocoa powder—processed with alkali
Buttermilk	Chocolate
Sour milk	
Pickle juice	
Sour cream	
Yogurt	
Mayonnaise	
Salad dressing	
Miracle Whip	
Soda Pop	
Honey	
Molasses	

- The acids that we will use today are lemon juice, vinegar, cream of tartar, and buttermilk.
- Cream of tartar is an acid in powdered form. It is very expensive, because it is a by-product of wine making. A by-product is something that is produced as a result of making something else. Cream of tartar is a little white crust around the edge of an empty wine barrel.
- Buttermilk is also an acid, because it contains *lactic acid*, which is found in sour milk and most other cultured dairy products like sour cream and yogurt.

Directions:

Note: adding food coloring is strictly to make the demonstrations more easily seen.

- Label jars with appropriate variable. Place 1 teaspoon of baking soda in the bottom of each jar. Add 2 teaspoons of cream of tartar to appropriate jar, and appropriate food coloring:
  - White: buttermilk
  - Pink: vinegar
  - Blue: cream of tartar
  - Yellow: lemon juice
- Measure out in individual containers 1/3 cup of lemon juice, buttermilk, vinegar, and water (for cream of tartar).
- Have 4 volunteers come up.
- Ask: What do you think will happen?

- Which one will "foam" the quickest?
- Which one do you think will be the slowest?

On the count of three, have one student pour the variable into the jar. Have the second student hold his or her finger at the top level where the foam reaches. Evaluate the reaction.

- Were these results different than you expected?
- Which one of these results surprised you the most?

Compare results with a variable from **What makes the Best Chocolate Cupcakes?**

The cupcake made with vinegar will usually be the shortest, and buttermilk the highest. The other two variables will be some where in the middle.

Experiment B

- Locate the 5th quart jar. Add 1 tablespoon of commercially prepared baking powder. Have a student come and add ½ cup of water.

- *Observation:* What happened?

- Compare next to the baking soda and cream of tartar reaction—which should still be making a fizzing noise.

- The baking powder will make a little foam, and will be cloudy.

- The **baking soda and cream of tartar** are basically the same thing as **baking powder**, but the baking powder contains a little bit of **cornstarch** (used to make pudding thick, or gravy), which helps to keep the **baking soda and cream of tartar** separate so that the can not react as quickly.

- The **cornstarch** is what makes the solution cloudy.

- What are some other **Acidic** foods you could use at home to make baked goods?
  i.e.—sour cream or soda pop in cake or mayonnaise in biscuits.

Acid/Base Reactions: It's not just Volcanoes!

Which one was the fastest?

Which one took the longest?

What happened with the cream of tartar?

Have you seen any of these reactions in different foods?

Were you surprised by any of these reactions? Why?

What are some ***acidic*** foods in your house?

White: buttermilk
Pink: vinegar
Blue: cream of tartar
Yellow: lemon juice

Try it at Home!

Benny's Birthday Cake

From the *Boxcar Children's* Cookbook

2 ½ cups flour	2 round 9" cake pans, or 24 cupcakes
½ cup cocoa powder	large mixing bowl
1 ¾ cup sugar	electric mixer
½ cup vegetable oil	measuring cups
2 teaspoons vanilla	rubber scraper
1 ¾ cup water	no-stick cooking spray
2 eggs	table knife
2 teaspoons baking soda	toothpicks
2 Tablespoons vinegar	wire cooling rack

7. Preheat oven to 350 degrees. Spray the cake pans with no-stick cooking spray.

8. Put flour, sugar, cocoa, and baking soda into the mixing bowl. Mix on low until well blended.

9. Add cooking oil, vinegar, vanilla, and water. Mix on medium until smooth. Scrape sides and bottom of the bowl with the rubber scraper to make sure all ingredients are blended.

10. Divide the batter evenly between the cake pans.

11. Bake 35-40 minutes. (15 minutes for cupcakes) Test by sticking a toothpick into the center of each layer. If the toothpicks come out clean, the cake is done.

12. Cool 15 minutes on wire rack.

Variations:

A. If you liked the *baking powder* cupcakes best, substitute baking soda and vinegar for ½ teaspoon baking soda, and 1 Tablespoon baking powder.

C. For *buttermilk* variation, substitute water with 2 cups buttermilk, and omit vinegar.

D. *Cream of tartar*: Reduce baking soda to 1 teaspoon, and substitute vinegar with 2 teaspoons cream of tartar.

E. *Be Creative*! Try your own variation with acids you have in your fridge (soda pop, pickle juice, yogurt, etc)

Acid/Base Reactions: It's not just Volcanoes!

Estimated time: 15 minutes

Learning Objectives following this session, the participants will be able to:

3) Discuss the purpose of baking powder and how it makes things rise.
4) To understand that other acid/base reactions can be used to create the same effect.

Materials:

4 quart jars
Baking soda
4-1/2 measuring devices
Vinegar
Lemon juice
Buttermilk
Cream of tartar
Tape
Markers
Table covering

Description:

In this experiment, 4 different acids will be reacted with baking soda. Each reaction will be evaluated for speed, height, and length of time that reaction continues. The results will then be compared to baked goods with similar acid/base properties, and differences between the baked product and jar reaction will be discussed.

Results:

The vinegar reaction will occur the fastest, then lemon juice (which sometimes is the highest). The cream of tartar solution will not foam very much, but will continue to make fizzing bubbles (similar to a soda pop) for several minutes. Little change will be seen in the buttermilk solution. The opposite reaction will be seen in the cupcakes. Buttermilk will be the lightest, followed by cream of tartar. Vinegar will be the last. This is because the carbon dioxide released by the vinegar and baking soda in the batter escapes before the cupcake is baked enough to trap the air inside. The buttermilk is the slowest to react, so it continues to form bubbles while in the oven.

Discussion:

- Everyone has seen what happens when vinegar is poured onto baking soda, but did you know that this is the same reaction that happens when muffins, brownies, cakes, cookies and lots of other baked goods rise when cooked?
- What are acids and bases,

  Acids are sour
  Bases are bitter and slippery

  Why do they react so violently?
  Why do they make baked goods "fluffier?"

Common Household Items

Acids:	*Bases:*
Lemon Juice	Baking Powder
Vinegar	soap
Cream of tartar	fats
Buttermilk	cocoa powder
Sour milk	
Pickle juice	
Sour cream	
Yogurt	
Mayonnaise	
Salad dressing	
Miracle Whip	

Directions:

Note: If performing for a large crowd, it might be helpful to color each experiment so that they can be more visible to the group.

- Label jars with appropriate variable. Place 1 teaspoon of baking soda in the bottom of each jar. Add 2 teaspoons of cream of tartar to appropriate jar. Measure out in individual containers ½ cup of lemon juice, buttermilk, vinegar, and water (for cream of tartar).
- Have 4 or 8 volunteers come up (1 or 2 per jar).
- Ask: What do you think will happen?
- Which one will "foam" the quickest?
- Which one do you think will be the slowest?

On the count of three, have one student pour the variable into the jar. Have the second student hold his or her finger at the top level where the foam reaches. Evaluate the reaction.
Note: The vinegar should react the quickest, followed by lemon juice. The cream of tartar solution will not react quickly, but will make fizzing noises for several minutes afterwards. Little foaming will be seen in the buttermilk.

- Where these results different than you expected?
- Which one surprised you the most?

Compare results with a variable from **What makes the Best Chocolate Cupcakes?**

The vinegar reaction will usually be the shortest, and buttermilk the highest. The other two variables will be very similar.

Acid/Base Reactions: It's not just Volcanoes!

Which one was the fastest?

Which one took the longest?

What happened with the cream of tartar?

Have you seen any of these reactions in different foods?

Were you surprised by any of these reactions? Why?

What are some ***acid*** foods in your house?

Try it at Home!

Irish Soda Bread

From Better Homes and Gardens *New Cook Book*

2 cups all-purpose flour
1 teaspoon baking powder
½ teaspoon baking soda
3 tablespoons margarine or butter
1 beaten egg
¾ cup buttermilk *or* sour milk
1 beaten egg

In bowl combine flour, baking soda, baking powder, and ¼ teaspoon salt. Cut in margarine till mixture resembles coarse crumbs. Combine 1 egg and buttermilk; add to flour mixture. Stir just till moistened. On a lightly floured surface, knead gently for 12 strokes. On a greased baking sheet, shape dough into a 6-inch-round loaf. Cut a 4-inch cross, ¼ inch deep, on the top. Brush with 1 beaten egg. Bake in a 375-degree oven about 35 minutes or till golden. Cool on a rack. *Serves 16*.

Brown Irish Soda Bread: substitute one cup of white flour with 1 cup of whole-wheat flour.

Sweet-Raisin Irish Soda Bread: Prepare as above, except add 2 tablespoons brown sugar to the flour mixture and 1/3 cup raisins or currants to the buttermilk mixture.

Substitutions:
Use fresh milk for sour milk, but add 1 Tablespoon lemon juice or vinegar to mixture.

Try omitting baking powder, and using ¾ teaspoon baking soda, and ½ teaspoon cream of tartar.

Or, try omitting baking powder, and using fresh milk, ¾ teaspoon baking soda, and 1 teaspoon cream of tartar.

The Affect of Acids and Bases on the Color of Yellow Cake
Estimated time: 35 minutes

Learning Objective following this session, the participants will be able to:

1) Discuss the affects of acids and bases on the color, texture, and flavor of yellow cake.
2) Discuss how to select and modify acid/base variables to obtain a desirable product.

Materials:

Flour
Sugar
Baking soda
Vegetable oil
Vanilla
Water
Buttermilk
Baking powder
Cream of tartar
Liquid egg mixture
4 mixing bowls
4 spoons
4 sets of measuring cups
4 sets of measuring spoons
4 butter knives, or leveling spatulas
4 colors of cupcake liners, six of each color
Pans for 24 cupcakes
Frosting
Sprinkles
Napkins and/or small paper plates
No-stick cooking spray

Description:

In this experiment, we will try 4 different combinations of acids and bases in the mix and evaluate the effect on color and texture of the product.

A) Control (normal baking powder only).
B) Additional acid (cream of tartar),
C) Additional base,
D) Extra extra base.

Adult Preparation:

Pre-heat oven to 350. Place six of each color of paper liners in cupcake pans, preferably in the same area. Lightly spray the inside of each liner with the no-stick cooking spray (this keeps the paper from sticking to the cupcake). Have children measure out, being sure to use the knives or spatulas to level the tops of the scoops. Mix well. *for a faster assignment, and less materials, this could be done ahead by an adult.

Assign each group a variable. Have adult helpers assist the students in proper measuring of all ingredients. Be sure to mix dry things together before adding the wet ingredients!

Results: The Extra Extra Base should be the most yellow in color, but have an after-taste. It is common for it to "cave in" after cooling, and be grainy in texture.

Extra base will be flatter than some of the other products, little taste difference should be see. Texture may be slightly grainy.

The extra acid and control should appear almost white. The texture should be fine and light.

Discussion:

- Ask the children if the know what happens when vinegar is poured onto baking soda.
- Do you know that is the same kind of reaction that happens when baking powder is put into a cake or cookie mix?
- Did you know that there are a lot of other things in your kitchen at home that will make the same foaming reaction?
- The cream of tartar is an acid that comes from wine-making, and the baking soda is a base called sodium bicarbonate. Baking soda is about the only base used in cooking, but there are lots of acids.
- Normal baking soda is made from two parts acid, and on part base.
- Baking powder can be a combination of baking soda and cream of tartar, or other acids.
- Acids and bases are opposite, so today, we are going to try changing the amount of acid and base in the recipe to see if the color and texture of the cupcakes changes.
- Which one do you think will work the best?
- Have you seen any of these at home?

Recipe:

Baking Powder (white cupcake liners)—Control

¾ cup all-purpose white flour
1/3 cup sugar
1 teaspoon baking powder, then wet ingredients
2 Tablespoons vegetable oil
½ teaspoon vanilla
1/3 cup water
2 Tablespoons liquid egg

Extra Acid (blue cupcake liners)

¾ cup all-purpose white flour
1/3 cup sugar
½ teaspoon cream of tartar, then wet ingredients
2 Tablespoons vegetable oil
½ teaspoon vanilla
1/3 cup water
2 Tablespoons liquid egg

Extra Base (pink cupcake liners)

¾ cup all-purpose white flour
1/3 cup sugar
1 teaspoon baking powder
¼ teaspoon baking soda
2 Tablespoons vegetable oil
1/3 cup water
½ teaspoon vanilla
2 Tablespoons liquid egg

Extra Extra Base (yellow cupcake liners)

¾ cup all-purpose white flour
1/3 cup sugar
1 teaspoon baking powder
½ *teaspoon baking soda*
2 Tablespoons vegetable oil
1/3 cup water
½ teaspoon vanilla
2 Tablespoons liquid egg

- Have children mix together. Warn them about over-mixing.
- Did any bubbles form in the batter?
- Was there a difference in color between other group's mixtures?

Bake for 15 minutes. While waiting, Perform **Acid/Base Reactions: It's not just Volcanoes!**

When cupcakes are finished and slightly cooled, cut one or two of each into small pieces, and allow the children to sample each one. Have them fill out the evaluation form. Cupcakes will usually be sufficiently cooled. Allow the children to frost, decorate and enjoy!

What makes the Best Yellow Cupcakes?

Which one was the fluffiest?

Which one was the most yellow?

Which one had the lightest color?

Did any of them taste funny?

Which one tasted the best?

Which one could you eat every day?

White: baking powder and a little baking soda
Pink: baking soda and vinegar
Blue: Baking soda and cream of tartar
Yellow: Baking soda and buttermilk

Try it at Home!

Basic Yellow Cake

3 cups flour	large mixing bowl
1 ¾ cup sugar	electric mixer
½ cup vegetable oil	measuring cups
2 teaspoons vanilla	rubber scraper
1 ¾ cup water	no-stick cooking spray
2 eggs	table knife
2 teaspoons baking soda	toothpicks
2 Tablespoons vinegar	wire cooling rack
2 round 9” cake pans, or 24 cupcakes	

13. Preheat oven to 350 degrees. Spray the cake pans with no-stick cooking spray.

14. Put flour, sugar, and baking soda into the mixing bowl. Mix on low until well blended.

15. Add cooking oil, vinegar, vanilla, and water. Mix on medium until smooth. Scrape sides and bottom of the bowl with the rubber scraper to make sure all ingredients are blended.

16. Divide the batter evenly between the cake pans.

17. Bake 35-40 minutes. (15 minutes for cupcakes) Test by sticking a toothpick into the center of each layer. If the toothpicks come out clean, the cake is done.

18. Cool 15 minutes on wire rack.

Variations:

A. If you liked the baking powder cupcakes best, substitute baking soda and vinegar for ½ teaspoon baking soda, and 1 Tablespoon baking powder.

F. For buttermilk variation, substitute water with buttermilk, and omit vinegar.

C. Cream of tartar: Substitute vinegar with 4 teaspoons cream of tartar

The Melting Properties of Chocolate

Estimated time: **15-20 minutes**

Learning Objectives Following this session, the participants will be able to:

- ✓ Discuss what diary product chocolate will melt in best
- ✓ Discuss which type of chocolate is best for melting
- ✓ To have fun, and enjoy cooking

Description:

The effect of four variables (water, milk, cream and sweetened condensed milk) on milk chocolate chips and semi-sweet chocolate chips are evaluated. Students observe speed of melting, and evaluate for desirability.

It is recommended to perform experiment first, then do group discussion.

Results:

Neither chip should combine well with water, or milk. The semi-sweet chips should combine better with the cream and sweetened condensed milk.

Materials needed:

2 microwaves
Permanent marker
Several microwave-safe containers
A spoon for each cup
Graham crackers, broken into small pieces—one for each variable per child
Milk chocolate chips
Semi-sweet chocolate chips
Water
Milk
Cream
Sweetened condensed milk

Directions:

Have one group of students scoop ½ a cup of milk-chocolate chips into each of their containers. Have them add an additional ½ cup of water, milk, and cream, etc. Have the students label the containers with each item.

Have the second group of students follow the same methods using the semi-sweet chocolate chips.

Microwave the items all together if jars will fit in microwave, and the microwave has a rotating table. Use the low or defrost setting.

Ask the children if they have ever seen chocolate with white spots on it. These white spots are crystals that have formed in the chocolate because it is old or was heated too much. Explain to the children that chocolate needs to be melted at a low heat so that will not burn or form white spots.

Microwave for 2 minutes on medium or low heat. Some microwaves may take more or less time. Stir with individual spoons upon removal. Have children try a spoonful of each variable on a graham cracker, and rate on the table provided.

Discussion:

Discuss the results with the children. What differences did they see between the different liquids? Was there a difference in taste, color, and texture? Which ones would they eat again? Which ones would they never try again? Why did some work better than others? *Explanation*: Chocolate is mostly fat and sugar, so the liquids with the most of these ingredients were the ones that the chocolate would dissolve into the best.

Type of chip:	Water	Milk	Cream	Sweetened Condensed Milk
Did it melt completely?				
What does it look like?				
What does it taste like?				
What would it be good with?				

Try it at Home!

Chocolate Revel Bars

1 cup butter or margarine
2 ½ cups flour
2 cups packed brown sugar
2 eggs
4 teaspoons vanilla
1 teaspoon baking soda
3 cups quick-cooking rolled oats
1 ½ cups semi-sweet chocolate chips
1-14 ounce can sweetened condensed milk
2 Tablespoons butter
½ cup chopped walnuts

In bowl beat 1 cup butter for 30 seconds. Add about half the flour, the brown sugar, eggs, 2 teaspoons vanilla, and baking soda. Beat until combined. Add remaining flour and rolled oats. In medium saucepan, combine chocolate chips, sweetened condensed milk and 2 Tablespoons butter. Cook on low stirring until chocolate melts. Remove from heat. Stir in walnuts and remaining 2 teaspoons of vanilla. Press 2/3 of the rolled oats into the bottom of an ungreased 15x10x1 pan. Spread chocolate mixture over oat mixture. Use fingers to crumble remaining oat mixture over chocolate mixture. Bake at 350 for 25 minutes, or until top is slightly browned.

Easy Hot-Fudge Sauce

½ cup semi-sweet chocolate chips
½ cup sweetened condensed milk

Microwave together on defrost for 1 minute. Stir until smooth. Microwave an additional 30 seconds to 1 minute if needed. Serve and enjoy!

Easy Ganache

4 ounces semi-sweet chocolate pieces
3 fluid ounces heavy cream

Chop chocolate pieces and place into a bowl. Heat the cream until just barely boiling (small bubbles start to appear). Pour cream over chocolate, and stir until smooth and glossy. Allow to cool slightly before using.

Uses:

Can be poured over cakes for a thick and rich frosting,

used as a filling between cake layers,

or add mint flavoring, allow to cool completely, then shape and cover in dipping chocolate for mint truffles.

Floating Eggs

Estimated time: 10 minutes

Learning Objective following this session, the participants will be able to:

1) Discuss what density is, and how it affects things
2) Discuss what are solutions

Materials:

3 quart jars
tap water
scissors
ruler
masking tape
salt
felt-tip pen
3 uncooked eggs
large spoon

Description:

During this experiment, density will be illustrated by comparing an egg's ability to float in a solution of salt water vs. tap water. Solutions will be discussed, and how they are created, and what are common solutions.

Results:

The "lake water" egg should sink to the bottom, while the ocean water egg will float on the top. The egg in the Great Salt Lake water should float higher in the water. This experiment can also be done with sugar, but ¾ cup is needed for the same amount of water.

Discussion:

- What is the difference between these two jars?
- Why is the egg in the "ocean" floating?
- What does the ocean water contain that lake water does not?

Explain that the egg will float in the ocean water because it contains lots of salt. The salt cannot be seen in the water because it has created a *solution*, which means that the salt has dissolved completely into the water. Adding salt to the water makes the water heavier. In this case, it made the water heavier than the egg, so the egg would float.

- What are some other things that can form a *solution*?

Sugar can also create a solution. It dissolves completely in water. (ie—KoolAid) An egg will also float in sugar, but ¾ cup is required for the same amount of water. This means that sugar is less dense than salt.

Directions:

- Fill each jar half-full of water. Label one jar as "lake water".
- Add ½ cup salt to another jar and label "ocean water".
- Add 1 cup salt to the third jar, and label "Great Salt Lake water"
- Have one or two students come up and place an egg in each jar. Notice what happens.
- Discuss and evaluate the results.

References: Wiese, J. (1998). Magic Science: 50 jaw-dropping, mind-boggling, head-scratching activities for kids.. John Wiley & Sons, Inc. New York.

Try it at Home!

Lemonade

2 quarts water

¾ cup fresh lemon juice (about 3 large lemons)

½ white sugar

In a large pan, combine sugar and water. Heat until sugar melts. Chill until cold, then add lemon juice and enjoy!

Variations:

Try making this with out heating the sugar-water. How long does it take for the sugar to dissolve? Will it dissolve completely? What happens if honey is used? Does it take more or less to sweeten the drink?

How Acids and Bases affect the Color of Fruits and Vegetables
Estimated time: 15 minutes

Learning Objectives Following this session the participants will be able to:

Discuss the differences between acids and bases, and their affect on fruit and vegetable pigments

Materials:

Purple cabbage
Lemon juice
Vinegar
Baking soda
Cream of tartar
3 clear containers
Labeling materials

Description:

In this experiment, the color of purple cabbage will be altered with different concentrations of acids and bases. All three acids can be used, or one. If used in equal amounts, the colors will vary depending on the strength of the different acids.

Adult Preparation:

Finely chop one cup of purple cabbage, cover with water and boil or microwave for a few minutes until water is dark purple. Allow to cool. This can be prepared several days in advance. Just before experiment, dilute with 3 cups of water so color changes can be better seen. Cabbage shreds can be removed, if desired.

Results:

The control should be a dark blue-purple. When the baking soda is added, the mixture will turn turquoise blue. The acid mixtures will be varying shades of reddish purple—almost pink.

Discussion:

- What makes the color purple?
  Red and blue. In nature, it is the same way.
- We will try to separate the different colors of the purple cabbage by adding different acids and bases to the jars.
- The acids and bases have opposite chemical properties, so one will remove the chemicals inside of the cabbage that give it the blue color, and one will remove the red pigments.
- If you were to try this at home and taste them, the vinegar would be crunchy and taste like pickles, and the base reaction would be very mushy and bitter.

Directions:

- Have students scoop 1 cup of cabbage mixture into each container. The amount of cabbage shreds does not matter. Discard leftover mixture, or divide between each variable.
- Have each jar labeled with one of the following:
    1) Control
    2) Vinegar
    3) Baking Soda

Variations:

This experiment can be done with almost any fruit or vegetable. Try blueberries, raspberries, blackberries, broccoli, spinach, etc. Some of the berries may need to be pureed in a blender prior to use.

Try it at Home!

Pennsylvania Red Cabbage

From Better Homes and Gardens *New Cookbook*

2 Tablespoons brown sugar
2 tablespoons vinegar
1 tablespoon cooking oil
¼ teaspoon caraway seed
2 cups shredded red (purple) cabbage
¾ cup coarsely chopped apple

In a large skillet stir together brown sugar, vinegar, oil, caraway seed, 2 tablespoons water, ¼ teaspoon salt, and dash pepper. Cook for 2 to 3 minutes or till hot, stirring occasionally. Stir in cabbage and apple. Cook, covered, over medium-low heat for 10 to 12 minutes or till crisp-tender, stirring occasionally. Serves 3 or 4.

Note: Notice the changes in color in the cabbage before, during, and after cooking.

ACTIVITY CORNER

Complied by Jaylene S. Turner

HAND PRINT

3/4 c. hot water
½ c. salt
2 c. flour
1 Tbsp. Oil

Put water and salt in a bowl and let the salt dissolve. Add flour and oil and mix together. Knead well. Put dough in pie tin. Flatten dough so it reaches the edges. Press child s hand in the dough and make a hand print. Make a small hole near the top. Use your finger or a pencil to write name below the hand print. Put the hand print in the oven and bake at 3000 for about 1 hour. Decorate the hand print with paint, crayons, glitter, or markers. Tie a ribbon through the hole and hang up.

MAGIC MAKEUP

2 Tbsp. Shortening
5 Tbsp. Cornstarch
5 drops of liquid dishwashing detergent
4 to 6 drops of food coloring

Mix shortening and cornstarch until creamy. Add dishwashing detergent and mix. Add food coloring and mix until color is even. The detergent keeps the food coloring from staining the skin and clothes. Yield: 1/4 cup.

Note - Color ratios: Army green - 1 drop red to 3 drops green; orange -3 drops yellow to 1 drip red; purple - 3 drips red to 1 drop blue; gray -3 drops blue to 2 drops red.

OCEAN IN A BOTTLE

Large clear plastic soda bottle water
oil (vegetable) blue or green food coloring

Rinse bottle. Remove all labels. Fill one half full of water and then one quarter full of oil. Add a few drops of food coloring. Tightly replace top. Rock, roll, and make waves.

FINGER PAINT

½ C. cornstarch
3 Tbsp. Sugar
½ tsp. Salt
2 c. cold water
food coloring

In a medium size saucepan, mix all of the ingredients together. Cook over low heat for 10 to 15 minutes until the mixture is smooth and thick. Stir with a wooden spoon while the mixture is cooking. After it has thickened, let it cool. Divide the mixture into as many containers as the number of colors you want. Add a little bit of food coloring to each container. Stir the coloring in first then decide if you want to add more. Cover tightly to store.

SAND MODELING

1 c. sand
½ c. cornstarch
1 tsp. Alum
3/4 c. hot water
food coloring, optional

Mix sand, cornstarch, and alum in bowl. Add hot water, stirring vigorously. Add food coloring if desired. Cook over medium heat until thick. Cool model as desired. Dry in sunshine. Store extra dough in airtight container. It will be grainy and stone-like and does not need shellac or varnish for protection. Makes 2 cups. Great for sand castles.

LASTING SAND SCULPTURE

2 c. sand
1 1/4 c. water
1 c. cornstarch

In an old heavy pan, mix and stir ingredients over low heat till thickens. Store in Ziploc bags. After molding, let sit to dry.

PUTTY

white school glue
liquid laundry starch
food coloring, optional

The recipe can be adjusted according to how much you would like to make. For a small amount, start with 1 cup of school glue in a bowl. Add the food coloring and stir. Begin pouring the starch into the bowl. It takes approximately twice as much starch as glue. Stir with your hands. Continue kneading putty until it no longer remains sticky. Add more starch if needed. Pour off any leftover starch. Store in a zip-lock bag. Have fun.

LIBRARY PASTE (INEDIBLE)

½ c. corn starch
3/4 c. cold water
6 c. boiling water

Make a paste of corn starch and cold water. Add to boiling water and stir until translucent. Cool to room temperature. Store in glass or plastic containers.

CRAFTY CINNAMON APPLESAUCE ORNAMENTS

1 c. applesauce
1 ½ c. (12 oz.) Ground cinnamon

Mix cinnamon with applesauce to form a stiff dough. Cut out shapes with cookie cutter. Make holes for ribbon if desired. Carefully lay out to dry. Let air dry several days, turning occasionally.

CRYSTAL GARDEN

4 Tbsp. Salt
4 Tbsp. Water
1 Tbsp. Ammonia
charcoal
colored inks, optional

Mix salt, water, and ammonia; pour over several pieces of charcoal in a small glass bowl. Put several drops of ink on the charcoal pieces. Leave the bowl in a place where it will be undisturbed and over several days, crystals will begin to form.

EDIBLE PLAY DOUGH

1 (18 oz.) Jar peanut butter
6 Tbsp. Honey
Nonfat dry or milk plus flour to right consistency

Mix all ingredients. Shape. Decorate (raisins, nuts, etc.) and eat.

WHIPPED SNOW

1 c. Ivory Snow flakes
1 c. water

Beat mixture with egg beater until consistency of frosting. Spread on cardboard or box with tongue depressor.

BUBBLES

1 c. liquid dishwashing detergent
2 c. warm water
3 Tbsp. Glycerin (buy at drug store)
½ tsp. Sugar

Mix together and store in airtight container. Add more glycerin if needed.

EPSOM SALT PANTING

Epsom salt
2 c. water (might be 2 t. or 2 Tbsp. I m not sure) paintbrush
colored paper

Mix Epsom salts with water. Use brush to paint this mixture onto colored paper. It will create a crystal appearance.

SOAP CRAYONS

2 Tbsp. Water
soap flakes
food coloring

Pour water into a 2 cup measuring cup. Fill the rest of the cup to the top with Ivory Flakes. Stir until mixture is thick, soupy paste without any big lumps. Add 30 to 40 drops of food coloring and stir. Scoop mixture into ice cube trays, pressing down until it is full. Dry cubes in a dry, warm place for 1 or 2 days until hard. Pop out of tray and store in an airtight container

HOMEMADE "PLASTIC"

1 env. un-flavored gelatin
food coloring, optional
3 Tbsp. Water
Plastic coffee can lid

Measure gelatin, water, and food coloring into a saucepan. Cook over medium heat until gelatin dissolves completely. Pour into a plastic lid and push all of the bubbles to the edge. Let this harden for 1 or 2 days until the edges are hard, but the center is still rubbery. Your plastic may be cut with scissors into sun-catchers, jewelry, tidily winks, or guitar pickers... .use your imagination! Allow your creations to dry for several more days.

FLUBBER

2 c. white glue
1 ½ c. warm water
1 c. hot water
3 tsp. Borax

Mix glue and warm water. Mix and dissolve Borax in hot water. Pour into glue mixture, 1/3 at a time, mixing thoroughly with bands after each addition. One fun thing to do with this is to flatten it out, stick straws in it, and blow bubbles.

ADDITIONAL RECIPES

Fruity Gelatin Pops

From Jell-O Brand Classic Recipes

1 cup boiling water
1 package (4-serving size) Jell-O Brand Gelatin Dessert, any flavor
1/3 cup sugar
1 1/3 cups cold juice, any flavor
6 (5-ounce) paper cups

Stir boiling water into gelatin and sugar in medium bowl at least 2 minutes until completely dissolved. Stir in cold juice. Pour into cups. Freeze about 2 hours or until almost firm. Insert wooden pop sticks into each handle.

Freeze 5 hours or overnight until firm. To remove pop from cup, place bottom of cup under warm running water for 15 seconds. Press firmly on bottom of cup to release pop. Do not twist or pull pop stick. Store leftover pops in freezer for up to 2 weeks.

For a **fizzy pop**, substitute a carbonated beverage for the cold juice.

Florida Sunshine Cups

From Jell-O Brand Classic Recipes

¾ cup boiling water
1 package (4-serving size) Jell-O Brand orange or lemon flavor gelatin
1 cup cold orange juice
½ cup fresh raspberries
1 can (11 ounces) mandarin orange segments, drained

Stir boiling water into gelatin in large bowl at least 2 minutes until completely dissolved. Stir in cold juice. Refrigerate 1 ½ hours or until thickened (spoon draw through leaves definite impression).

Measure ¾ cup thickened gelatin into medium bowl; set aside. Stir fruit into remaining gelatin. Pour into serving bowl or 6 dessert dishes.

Beat reserved gelatin with electric mixer on high speed until fluffy and about doubled in volume. Spoon over gelatin into bowl or dishes.

Refrigerate 3 hours or until firm.

Gelatin Pinwheels

From Jell-O Brand Classic Recipes

1 package (4-serving size) Jell-O Brand Gelatin Dessert, any flavor
½ cup warm water
1 ½ cups miniature marshmallows or 12 large marshmallows

Spray bottom and sides of 8- or 9-inch square pan lightly with no stick cooking spray.

Mix gelatin and water in 1 ½- to 2-quart microwaveable bowl. Microwave on High 1 ½ minutes; stir until completely dissolved. Add marshmallows. Microwave 1 minute or until marshmallows are puffed and almost melted. Remove from oven. Stir mixture slowly and gently until marshmallows are completely melted and mixture is smooth. Creamy layer will float to the top. Pour into prepared pan.

Refrigerate 45 minutes or until set. Loosen edges with knife. Starting at 1 edge, roll up tightly like a jelly roll. With seam-side down, cut into ½-inch thick slices.

Serve immediately or refrigerate until ready to serve.

Makes 10 to 12 pieces.

Jell-O Jigglers

From Jell-O Brand Classic Recipes

2 ½ cups boiling water or boiling apple juice (Do not add cold water or cold juice)

2 packages (8-serving size) or 4 packages (4-serving size) Jell-O Brand Gelatin Dessert, any flavor.

Stir boiling water or boiling juice into gelatin in large bowl at least 3 minutes until completely dissolved. Pour into 13x9-inch pan.

Refrigerate 3 hours or until firm. Dip bottom of pan in warm water about 15 seconds. Cut into decorative shapes with cookie cutters all the way through gelatin, or cut into 1-inch squares. Lift from pan.

Makes about 24 pieces.

Easy Pudding Milk Shake

From Jell-O Brand Classic Recipes

3 cups cold milk
1 package (4-serving size) Jell-O Instant Pudding and Pie filling, any flavor
1 ½ cups ice cream, any flavor

Pour milk into blender container. Add pudding mix and ice cream; cover. Blend on high speed 30 seconds or until smooth. Pour into glasses and garnish as desired. Serve immediately.

Makes about 5 servings.

Paddle Cookie Pops

From Gold Medal's *The Rainbow Bakery*

1 cup sugar
1 cup (2 sticks) margarine or butter, softened
½ teaspoon vanilla
1 egg
2 2/3 cups Gold Medal all-purpose flour

3 food colors of your choice
About 48 flat wooden sticks with rounded ends

Heat oven to 375. Stir sugar, margarine, vanilla and egg into large bowl until smooth. Stir in flour. Divide dough into 3 equal parts. Stir 4 drops of one food color into each part of dough to make three different colors of dough.

Shape dough into 1-inch balls, using a bit of each color of dough for each ball. Put balls 2 inches apart on ungreased cookie sheet. Poke wooden stick into side of each ball. Press balls until ¼ inch thick, using the bottom of a glass that you have dipped in sugar.

Bake 9-11 minutes or until slightly firm and edges are lightly golden brown. Cool 1 minute before taking cookies off cookie sheet. Cool completely. Frost and decorate cookies, if you like. *Makes about 4 dozen cookies.*

Rainbow Sprinklers

From Gold Medal's *The Rainbow Bakery*

1 ½ cups sugar
½ cup (1 stick) margarine or butter, softened
½ cup shortening
2 eggs
2 ¾ cups Gold Medal all-purpose flour
2 teaspoons cream of tartar
1 teaspoon baking soda
¼ teaspoon salt
Rainbow Dust

Heat oven to 400. Stir sugar, margarine, shortening and eggs into large bowl until mixed. Stir in flour, cream of tartar, baking soda and salt.

Shape dough by rounded teaspoonfuls into balls. Roll balls into Rainbow Dust until coated. Place about 2 inches apart on ungreased cookie sheet.

Bake 8-10 minutes or until light golden and cracked on top. Right away, take cookies off cookie sheet. *Makes about 6 dozen cookies*.

Rainbow Dust

From Gold Medal's *The Rainbow Bakery*

Color	Number of drops of Liquid Food Color
Orange	2 drops yellow and 2 drops red
Peach	4 drops yellow and 1 drop red
Yellow	4 drops yellow
Pale yellow	2 drops yellow
Green	8 drops green
Lime green	3 drops yellow and 1 drop green
Blue	5 drops blue
Turquoise blue	3 drops blue and 1 drop green
Baby blue	2 drops blue
Purple	3 drops red and 2 drops blue
Red	10 drops red
Rose	5 drops red and 1 drop blue
Pink	1 drop red

Place ½ sugar in a re-sealable plastic bag. Pick a color from the chart, and add the food colors to the sugar in the bag. Seal bag and squeeze, shake or stir until sugar is evenly coated. Store sugar in bag.

Cool & Crazy Dough

From Gold Medal's *The Rainbow Bakery*

1 cup Gold Medal all-purpose flour
2 teaspoons cream of tartar
½ teaspoon salt
1 cup water
1 tablespoon vegetable oil
About 15 drops of your favorite food color

Put all ingredients in 1 ½-quart saucepan. Cook over medium heat about 4 minutes, stirring very hart, until mixture forms a ball.

Take ball of dough out of saucepan, and let it stand on counter 5 to 10 minutes to cool.

Squeeze dough about 30 seconds or until it is mixed and smooth. Cool completely. Use dough to make fun shapes. Store dough tightly wrapped in refrigerator up to 2 weeks. *Makes about 1 1/3 cups dough.*

Apple Wrapper Pie

From Gold Medal's *The Rainbow Bakery*

1 cup Gold Medal all-purpose flour
½ teaspoon salt
1/3 cup shortening
2 to 3 tablespoons cold water
2/3 cups packed brown sugar
1/3 cup Gold Medal all-purpose flour
4 medium cooking apples, thinly sliced (4 cups)
1 tablespoon butter or margarine

Stir 1 cup flour and the salt in medium bowl until mixed. Cut shortening into flour mixture, by crisscrossing with 2 knives, until crumbly. Sprinkle with cold water, 1 tablespoon at a time, and toss with fork until dough forms. Shape dough into a ball. Wrap in plastic wrap, and refrigerate 15 minutes.

Heat oven to 425. Put dough onto floured surface. Roll dough into 13-inch circle, using rolling pin. Put on ungreased large cookie sheet.

Stir brown sugar, 1/3 cup flour and the apples in large bowl. Mound apple mixture on center of dough up to 3 inches of edge. Put pieces of the margarine on apples. Fold edge of dough over apples. Bake 30 to 35 minutes or until crust is light golden brown. *Makes 8 servings.*

Party Noodle Chips

From Food and Nutrition: Luncheon Wizardry Phase 3

1 package (8 oz) wide noodles
1 bottle (8 oz) oil and vinegar-type salad dressing

1. Cook noodles in boiling water 3 or 4 minutes, or until tender, yet firm. Drain.
2. Mix together noodles and salad dressing, coating noodles thoroughly.
3. Divide noodles in half.
4. Spread on half of noodles in a shallow baking pan and bake at 350 for 30 to 45 minutes or until golden brown, stirring occasionally.
5. Drain thoroughly on a paper towel.
6. Repeat with second half of noodles.
7. Sprinkle with salt if you want, then store in a tightly covered container.

ADDITIONAL RESOURCES

Family-Friendly Activities

Clabber Girl Baking Powder
www.clabbergirl.com/resourcecenter/

The American Egg Board
http://www.aeb.org

University of Wisconsin BioTrek Outreach
http://www.biotech.wisc.edu/outreach

Steve Spangler Science Projects
http://www.stevespanglerscience.com

Nutrition Science Projects: Learn about food and health
http://www.sciencemadesimple.com/nutrition_projects.html

ZOOM: Activities from the Show
http://pbskids.org/zoom/activities/sci/

Recipes

Family Fun Magazine
www.familyfun.com

Fun with Fruits and Vegetables

The California Kiwi Fruit Commission
http://www.kiwifruit.org

Whole Foods, Inc.
http://www.whfoods.com

REFERENCES

The Real Amazing Fruits

1. Pineapple. California Rare Fruit Growers, Inc. Retrieved 30 March 2006 http://www.crfg.org/pubs/ff/pineapple.html.
2. Levins, H. Symbolism of the Pineapple: being the brief and colorful history of a truly American fruit. Retrieved 30 March 2006. http://www.levins.com/pineapple.html.
3. Kiwifruit. (1996). California Rare Fruit Growers, Inc. Retrieved 30 March 2006. http://www.crfg.org/pubs/ff/kiwifruit.html.
4. Papaya. Retrieved 30 March 2006. http://www.crfg.org/pubs/ff/papaya.html
5. Papaya. The world's healthiest foods. *Whole Foods, Inc*. Retrieved 30 March 2006. http://www.whfoods.com/genpage.php?tname=foodspice&dbid=47.
6. Labensky, S.; Hause, A. (2003). Tropical Fruit Salad with Yogurt Dressing. *On Cooking: Third Edition.* Pearson Education, Inc. Upper Saddle River, New Jersey.
7. Mean Green Peanut Butter Sandwich (2000). The California Kiwi Fruit Commission. Retrieved 30 March 2006. http://www.kiwifruit.org/consumer/recipes/peanutbutter.htm.

Chocolate Cupcakes

1. Blain, D. (1991). Benny's Birthday Cake. *The Boxcar Children's Cookbook*. Albert Whitman & Company, Morton Grove, Ill.

Crispy Rice Treats

1. Marshmallow Crispy Squares (2006). Kraft Jet-Puffed Marshmallows.

Boiled Eggs

1. *Food science: kitchen mysteries revealed*. (2000). Learning Seed. Lake Zurich, Ill.
2. New cook book (1989). *Better Homes and Gardens.* Meredith Corporation. Des Moines, Iowa. 146.
3. The American Egg Board. Retrieved March 31, 2006. http://www.aeb.org/LearnMore/EggFacts.htm#aircell.

Acid/Base Reactions: It's not just Volcanoes! Large Group (B)

1. *Food science: Kitchen mysteries revealed*. (2000). Learning Seed. Lake Zurich, Ill.
2. Blain, D. (1991). Benny's Birthday Cake. *The Boxcar Children's Cookbook*. Albert Whitman & Company, Morton Grove, Ill.

Acid/Base Reactions: It's not just Volcanoes!

1. New cook book (1989). *Better Homes and Gardens.* Meredith Corporation. Des Moines, Iowa. 146.

Floating Eggs

1. Wiese, J. (1998). Magic science: 50 jaw-dropping, mind-boggling, head-scratching activities for kids.. John Wiley & Sons, Inc. New York.

Activity Corner

Compiled by Jaylene S. Turner. (2006). Utah.

Additional Recipes

1. Jell-O Brand Classic Recipes. (2002). Publications International, Ltd. Kraft Foods Holdings.
2. The Rainbow Bakery. (1998). Gold Medal Flour. General Mills, Inc. Minneapolis, MN.
3. Lauritzen, G. Saunders, K. (1990). Foods & Nutrition: Luncheon Wizardry Phase 3. Cooperative Extension Service. Utah State University.

Every Kitchen is a Chemistry Lab

Project Summary

For this project, a series of food science projects were created to emphasize different principles used in the baking process. The projects were geared towards third and fourth grade children, with the purpose of encouraging them to learn the art of cooking, create an awareness of the chemistry principles involved in cooking. Lesson plans were written with the intent of being used in classrooms and smaller educational experiences by the Utah State Extension Service. The program also includes evaluation worksheets of the experiment, and a *Try it at Home!* section to provide students with a way to practice the principles learned, interact with parents, best of all: Taste!

Introduction

Cooking is a fundamental life-skill. It is a requirement for resourceful, healthier living. It strengthens cultural ties, and unites family members. The need to teach basic cooking skills in schools has increased over the years. The fast-paced lifestyle of today has prevented many parents from learning cooking skills, or allowed them to teach their children these skills (Gates, Short, 2002). Basic cooking skills also provide a practical way to use math, reading, and logic skills that are taught in schools. It provides the hands-on learning that children love. Cooking education contributes to a positive self-image and well-being for a child (New York New Amsterdam News, 2004) throughout their entire life.

Need for Skills

Cooking skills have long been viewed as part of essential education. It has been the focus of several service missions to African countries since 1920 (Higgs, 2004). Those in lower economic conditions commonly lack the ability to prepare nutritious meals. Learning food preparation skills and budgeting can greatly reduce a family's food insecurity and become a vital

step towards becoming self-sufficient (Mattern, (2005). A recent study in United Kingdom discovered that 90% of 12-13 year-old children knew how to use the internet, but only 50% knew how to boil an egg (Cruickshank, 2005). These and other statistics have encouraged the government to start an after-school "Food Club" for underprivileged youth. Parents especially have been appreciative of the results. Children have participated more in home food decisions, and preparation (Hyland, 2006).

Learning these food preparation skills also helped the children be more aware of nutrition, encouraged the youth to make healthier food choices at home (Hyland, 2006). A 1999 USDA study found that foods baked at home contained more of vital nutrients than ready-prepared items (Clabber Girl, 2006). Many families are resorting to prepared foods simply because they lack the skills to prepare a meal (Gates, Stort, 2002).

Having basic cooking and budgeting skills can mean the difference between malnutrition and health during times of economic hardship. It has also been proven that for every dollar that is spent on nutrition education saves over ten dollars in long-term public health costs (Mattern, 2005). Emphasizing the importance of these fundamental skills throughout life can benefit entire communities as well as individuals.

Involving Science

The basis of a science project is that it must follow scientific method. It is an attempt to answer a specific question. Research starts with a hypothesis, and ends with a conclusion or results. One of the most vital parts of an experiment is that there must always have a control. Little can be discovered about the variations without the help of something constant. The basis of an experiment is that questions are asked, and comparisons are made between something that is known and an unknown (Zinnen, 2005).

Research found that changing the ratio of these acid/base compounds can also affect the volume, texture, color and flavor of the product. In an experiment conducted for this project, it was found that increased amounts of baking soda (double amount) added to a basic yellow cake batter would increase the yellow color of the product. Adversely, this also gave a "grainy" texture to the product, reduced volume, and left a bitter after-taste. The control, which used commercial baking powder, was light and fluffy, with no after-taste. The color was very light. Without the use of a control, the changes to the cake could have gone un-noticed.

A challenge with experiments involving children is the amount of variables that can exist in cooking. When testing the effect of the amount of baking powder in a cupcake, volume can also be affected by the amount of stirring, if ingredients were properly measured, and temperature variations among ovens. This increases the amount of education and direction that must be included to clearly instruct students, so that the manipulation of multiple variables can be as restricted as much as possible.

Children are full of questions and curiosity about everyday life. All experiments attempt to take ordinary items and show a unique perspective. The history and science of many items were researched and found to be intriguing by adults and children alike. For example, chemical leaveners such as baking powder and baking soda are found in quick breads and have been used since the late 1700's. Some of the first reactions used were baking soda and a variety of acid compounds varying from potash to buttermilk.

When baking powder was first introduced in 1854, it was considered a great luxury. Having any kind of leavener that could be prepared faster than yeast was a wonderful convince. Baking powder became the most popular of chemical leveners quickly because it was a shelf-stable item that did not require any pre-prepared ingredients such as "clabbered" milk (sour milk)

or would leave bitter after-tastes like potash (Clabber Girl, 2006). Potash is a combination of potassium carbonate and similar salts. It is commonly used in soap and fertilizer (Potash, 2006).

Baking powder is now a common household item. So common, that the few people are aware of the ancient science is involved in this process. Another experiment was written to illustrate the difference between baking powder and baking soda reacted with different acids. The similarities and differences were then discussed. During several presentations of this project, children were wide-eyed and thoroughly enjoyed the speed and intensity of the acid/base reactions. They were also shocked at the similarity between a common cooking ingredient, and the ever-popular science fair volcanoes.

Increasing Family Interaction

Food also represents emotional ties to country, culture, and safety. It is core to family traditions and lifestyle. It distinguishes individuals, families, and cultures, but also creates bonds of friendship and unity. In some countries, if their food is rejected, it is considered a rejection of the individual. Lesley Johnson describes her experiences cooking with her grandmothers, and learning family recipes, and how it creates family interaction:

> *That's the thing about cooking: Sure, eating fuels our bodies and keeps us alive, but to so many people, it is the act, the art of cooking that gives sustenance to the soul. It's family history—a common experience passed down throughout generations. . . It anchors us to our past* (Johnson, 2005).

Learning new skills together in the kitchen can continue and create more "common [experiences]" that can be passed to the future generations as well strengthening current ties. In the UK study, parents greatly enjoyed the increased participation in family meal planning and preparing, and the children also enjoyed learning new skills (Hyland, 2006). Harrison feels that one reason families are not cooking meals together at home is because young parents are

spending more time at work, and a good many have never been taught basic cooking skills. She stresses the need for the most basic skills to be taught, because they can be adapted to nearly any recipe (Short, Gates, 2002).

Conclusion

"Teaching cookery, food hygiene, nutrition, budgeting and parenting skills [are] fundamental to the nation's well-being" (Short, Gates, 2002). It is the hope that through this project, children and adults alike will be able to better understand the science of foods and cooking, and discover greater enjoyment through increased parent-child interactions and vital skills. Cooking gives them a chance to apply reading and math skills, find ways to answer questions, evaluate the cause and effect of actions taken, learn the importance of event-sequencing, and calculating (Clabber Girl, 2006). Assisting in the kitchen and contributing to food selection and preparation increases self-worth, and using healthier ingredients places children on a path towards a healthier, happier life (New York Amsterdam News, 2004) and influence generations to come.

Presentation Evaluation

Presentations were given at Adam's Elementary to the three third-grade classes, and a smaller presentation to a Cub Scout troop. These presentations also came to show that children prefer more action than talk, and love to touch, feel, and be involved. It is believed that parent-child interactions by sparking interest through the science of the demonstrations, and providing a fun but easy "homework" assignment through the *Try it at Home!* section. A participant said it best (while jumping up and down) "Yeah! *I* can make these at home with my mom!"

References

Higgs, C. (2004). Zenzele: African women's self-help oranizations in South Africa, 1927-1998. *African Studies Review*. December 2004. *47*(3).

Campers learn creative cuisine in Culinary Kids program. (2004) *New York Amsterdam News*. *95*(35). 20.

Cruickshank, G. (2005). British Egg Week cooks up a treat for the kids. *Poultry World*. September 2005. *159*(9).

Clabber Girl Learning Center. (2005). *Clabber Girl Baking Powder*. Retrieved 4 April 2006. http://www.clabbergirl.com/LearningCenter.php.

Zinnen, T. No trick more enlightening: Making every demonstration an experiment. Biotechnology Outreach. *University of Wisconsin Biotechnology*. 9 June 2005. Retrieved 30 March 2006. http://www.biotech.wisc.edu/outreach/everydemo.html.

Potash. *Wilkipedia: The free encyclopedia*. 22 March 2006. Retrieved 12 April 2006. http://en.wikipedia.org/wiki/Potash

Short, W. Gates, T. (2002). Teach how to cook, and you teach how to eat. *Farmers Weekly*. 6 December 2002. *137*(23).

Hyland, R. (2006). Nutrition-related health promotion through an after-school project: The responses of children and their families. *Social Sciences & Medicine*. February 2006. *62*(3).